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(54) A collapsible tank for liquids

(57) A rigid collapsible framework which supports a bag 32 in which liquids may be contained comprises two rectangular frames (10, 12) spaced by eight legs (14) pivotally connected to the frames and formed in two halves pivotally connected by bolt assemblies 24. The framework collapses as the bolt assemblies move along a slot in a bracing bar 28 towards the centre of the side of the tank. Latches 30 can prevent the framework collapsing and an elasticated waist 37 draws the fabric of the bag away from the framework to avoid its becoming trapped.

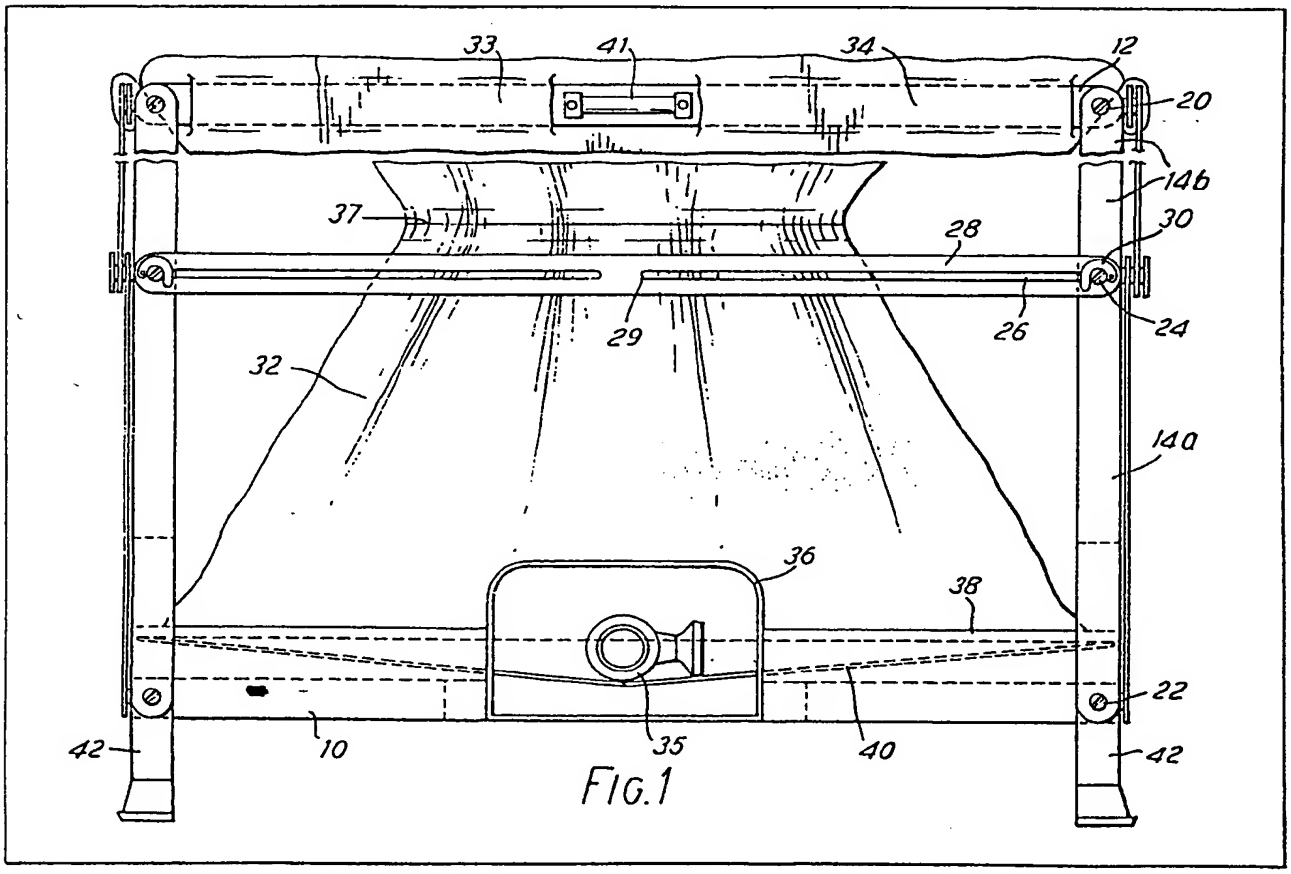

FIG.1

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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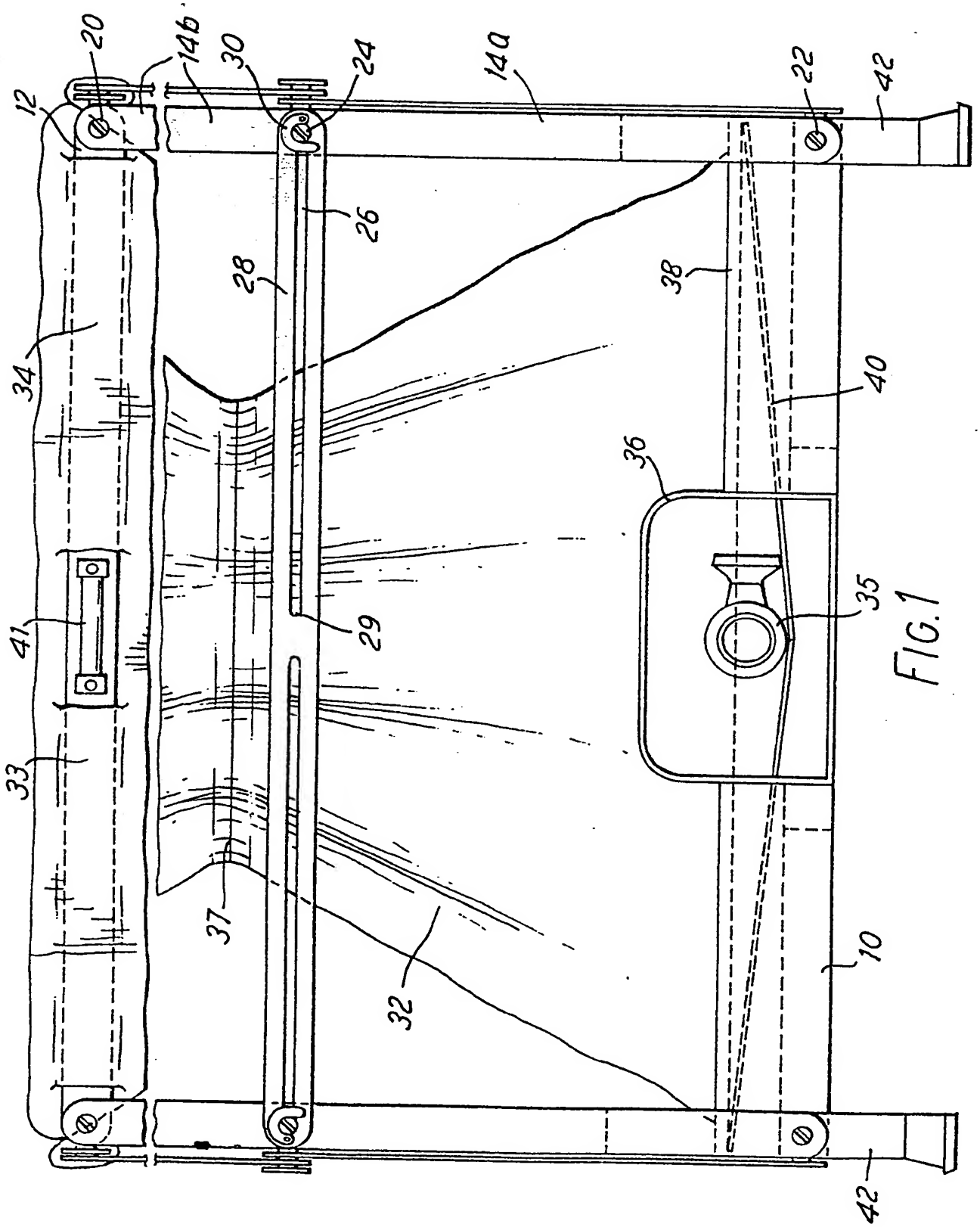

FIG.1

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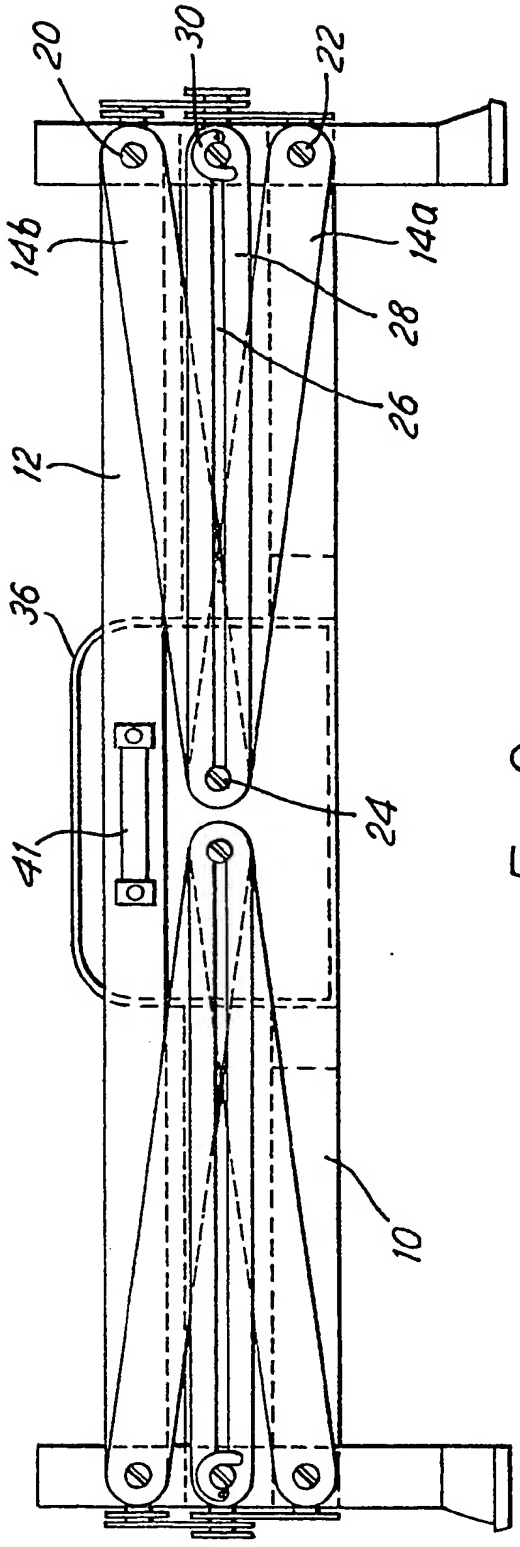

FIG. 2

SPECIFICATION

Collapsible tank for liquid

The present invention relates to the transport in bulk of liquids, using containers which are collapsible when empty. The capacity of the containers concerned is typically greater than $1m^3$ and may be much greater.

Previous such containers have included flexible bags of various shapes, manufactured from a variety of materials, such as rubber or a synthetic plastics material or from a composite material for instance a nylon fabric coated in rubber.

In order to provide greater protection for the bags when in use, some bags have the facility to be attached to rigid structures, for instance inside ISO standard containers, or inside supporting frameworks which may be collapsible.

Many synthetic plastics materials suffer cracking after repeated folding of a sheet along one line, a property which limits the lifetime of a collapsible tank made from the material.

The specification describes a container using a flexible bag manufactured from polypropylene, a material which is virtually indestructible under repeated folding. The bag of the present invention may therefore be expected to have a very long working life.

Another property of polypropylene is that it may be welded to itself. This property enables a variety of bag shapes to be constructed. The container to be described later comprises a flexible polypropylene bag for use in the transport of liquid in bulk, having the shape of a rectangular parallelepiped. The same property enables a polypropylene valve to be attached at a point low on one vertical face of the bag to enable liquid to be introduced to and evacuated from the bag.

The large amount of material used in making bags of the size under discussion may make handling of the empty bags difficult and may cause the bags to become trapped when supporting frameworks as mentioned above are collapsed.

The present specification describes a polypropylene bag for use in transport of liquid in bulk, having the shape of rectangular parallelepiped, and having attached one or more lengths of elasticated material forming a waist around the bag, which contracts as the bag is emptied. A bag of this type when housed in a collapsible framework will be less likely to become entangled in the framework, because the elasticated waist will help to maintain the material within the framework.

A particular preferred embodiment of the container according to the present invention is described later in more detail, but other embodiments are possible each having the general form of a polypropylene bag for use in transport of liquid in bulk, which in use is housed in a collapsible framework having the form of two plane frames one supported vertically above the other and both lying horizontally, the upper frame being supported when the frame is open by supporting members, which are collapsible or removable so that the upper frame may be lowered to a position close to the lower frame, the material of the flexible bag being maintained within the framework by the elasticated waist.

More specifically, the preferred embodiment has the form of a polypropylene bag having the shape of a rectangular parallelepiped, which bag is, in use, housed in a collapsible framework with the external appearance of a rectangular parallelepiped and comprising two square or rectangular frames which lie in horizontal planes, one frame maintained in a position vertically above the other by eight supporting bars each pivotally attached at one end to the lower frame at one corner of one vertical face of the parallelepiped and attached at the other end to the upper frame at the vertical face corner vertically above, each supporting bar being jointed midway along its length by a joint constrained to run along a horizontal course towards the centre of the vertical face when the framework is collapsed; the framework further comprising latches serving to constrain the movement of the joint at the midpoint of the supporting bars when the framework is fully extended, and the framework being able to be lifted by a fork lift truck by the provision of feet on the lower frame, serving to support the lower frame at a small distance from the surface below the container.

The bag preferably has an elasticated waist. For filling and emptying the bag a valve may be provided at a point low on one vertical face. Preferably, the valve is formed of polypropylene and the bag is welded to it.

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings in which:

Fig. 1 shows a side elevation of the complete container when the framework is fully expanded, and

Fig 2 shows a side elevation of the complete container when folded and empty.

The framework of the preferred embodiment will now be described, with reference to the diagrams, particularly to Fig 1, in which can be seen two horizontal members 10, 12 which form part of two square frames. These frames lie in horizontal planes one vertically above the other. The upper frame of which the member 12 is a part is supported above the lower frame of which member 10 is a part by eight supporting bars. One supporting bar will be described to show by example the construction and function of all eight.

The supporting bar comprises two equally long members 14a, 14b the first 14a pivotally attached at one end to one of the members 10 of the lower frame, at its end, the second 14b pivotally attached to a member 12 of the upper frame at a point 20 vertically above the point of attachment 22 of the first member to the lower frame. At their ends not attached to either the upper or lower frame the members 14a, 14b are pivotally attached to each other by means of a bolt assembly 24 which also passes through a

horizontal slot 26 in a horizontal strengthening bar 28, the bar being situated midway between the upper and lower frames. When the framework is to be collapsed the upper frame is moved vertically downwards, whilst the bolt assembly 24 at the middle of the supporting bar traverses the slot 26 in the strengthening bar 28, reaching the end 29 of the slot nearest the middle of the strengthening bar 28 when the framework is fully collapsed.

To ensure stability whilst the framework is open, a latch 30 may be attached to the strengthening bar 28 to hold the supporting bar 14 in the position shown in Fig 1. The latches have the form of a partial annulus preferably made from the same material as the framework, which is pivotally attached to the strengthening bar 28 at one end of the bar, so that when the supporting bar is straight the partial annulus falls due to gravity, defining a cylinder in space in which the bolt assembly 24 is constrained. The contents of the container are held in a large bag 32 which in the present embodiment is made from polypropylene, and has the form of a rectangular parallelepiped. The upper and lower frames are square with side length greater than the distance between the points 20 and 22 when the framework is fully extended. The bag is attached to the framework by means of a series of sleeves, of which two, 33, 34 are shown in Fig. 1. These sleeves are attached to the bag 32. Members of the upper frame such as member 12, pass through the sleeves.

Drainage of the contents of the bag 32 is effected through a valve 35 attached to the bag 32. To protect the valve two vertical hoops, of which one, 36 is shown in Fig 1, are attached one to each vertical face of one member 10 of the lower frame, at the middle of that member, through which hoops the valve 35 passes.

A line of elasticating material 37 is desirable, attached to the bag along a line extending entirely around the perimeter of the bag and defining a plane parallel or nearly parallel to the upper and lower frames, and equidistant or nearly equidistant from these two planes. The provision of such elasticating material facilitates collapse of the framework by drawing the material of the bag away from the members of the framework thereby avoiding material becoming trapped or punctured during the operation.

A skirt 38 of protective material, for instance 14 SWG mild steel, may extend around the lower portion of the framework, attached to the inside vertical face of the members of the lower frame, to guard the bag 32 against damage during handling, for instance by fork lift trucks.

To provide extra support to the bag 32, a base plate 40 may be attached to the framework so as to extend underneath the bag. It is desirable that this plate be shaped so that liquid in a partially empty bag is inclined to run towards the valve 35, thereby facilitating drainage.

Any or all pivotal joints 20, 22, 24 may comprise washers made from a material which will reduce friction, for instance nylon, to allow smooth operation. Such washers are particularly desirable in the bolt assembly 24 running in the slot 26 in the strengthening bar 28. Collapsing and opening of the framework is made more easy by the provision of a handle 40 on the members of the upper frame.

Permanent feet 42 may be attached to the lower frame to facilitate stacking and handling by fork lift trucks.

The bag 32 of the preferred embodiment is made from polypropylene. The valve 35 of the preferred embodiment is a 2" nominal bore polypropylene ball valve, to which the bag may be welded. It will be realised that a variety of materials may be used without altering the operation of the invention.

CLAIMS

1. A tank for liquid comprising a bag having a port through which liquid may enter or leave and a framework to which the bag is attached comprising first and second rigid, parallel frames held spaced by a collapsible spacing mechanism, the framework and the bag being so dimensioned that the bag, when full of liquid, is substantially entirely within the framework, when the spacing mechanism is fully extended.

2. A tank according to claim 1, further comprising means for drawing the fabric of the bag away from the spacing mechanism.

3. A tank according to claim 2, in which the means for drawing the fabric of the bag away from the spacing mechanism comprises a line of elasticated material extending substantially entirely around the bag and attached thereto.

4. A tank according to any of the above claims in which the frames are rectangular and are held in register by the spacing mechanism.

5. A tank according to claim 4 in which the spacing mechanism comprises a plurality of supporting bars connected to the first frame at or near a corner thereof and at or near the adjacent corner of the second frame.

6. A tank according to claim 5, in which four supporting bars are pivotally connected at one end at or near respective end portions of two opposite sides of the first rectangular frame and at the other end to corresponding points on the second frame, the bars comprising two equally long, rigid members pivotally connected to each other at their ends remote from the frames.

7. A tank according to claim 6 in which the supporting bars connected to one side of the frames are further connected, at a point substantially midway along their length, to a bracing bar which constrains the said point to move along the longitudinal axis of the bracing bar.

8. A tank according to claim 7, in which the connections between the bracing bar and the supporting bars comprise a bolt assembly having a bolt constrained to move in a longitudinal slot in the bracing bar.

9. A tank according to claim 8 in which the bolt

assembly provides the connection between the members of the supporting bars which are pivotable about th bolt of the bolt assembly.

10. A tank according to any of the above claims, further comprising locking means for locking the spacing mechanism in its extended state.

11. A tank according to claim 10 inasmuch as it is dependent on claims 7, 8 or 9, in which the locking means prev nts movement of the point along the longitudinal axis of the bracing bar.

12. A tank according to any of the above claims in which, in use, the bag rests on a plate attached to the framework which slopes towards the port.

13. A tank substantially as described above with reference to the drawings.

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